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PALLET UNLOADING AND ORIENTING DEVICE

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## PALLET UNLOADING AND ORIENTING DEVICE

### Abstract of the Disclosure

A novel device is described for unloading and orienting articles, such as cartons, stacked in tiers on a pallet.

The device includes

- (a) a tiltable pallet receiver having end walls, a back wall and a bottom wall, said receiver being supported on a support frame by means of pivotable mountings on said end walls, whereby it can in upright position receive a loaded pallet with the bottom wall substantially horizontal and then tilt until the pallet and tiered articles are resting on their sides on the receiver side wall with the article tiers forming a series of substantially vertical adjacent stacks,
- (b) a conveyor transfer section for receiving the pallet and tiered articles resting on their sides and intermittently advancing these in a primarily horizontal direction,
- (c) a single tier receiver for receiving a substantially vertical stack of tiered articles during an intermittent advance of the conveyor, said stack receiver being horizontally movable for moving the received stack laterally away from the next adjacent stack,
- (d) release means for dropping the stack of articles being held in the receiver in a vertically downward direction and
- (e) a curving delivery chute for receiving

the dropped stack and delivering  
the articles onto a horizontal  
table resting on their bottoms.

This invention relates to a device for unloading and orienting articles stacked in tiers on a pallet.

10 In modern brewery bottling plants, cartons or cases of empty bottles are stacked in tiers on pallets and stored in a storage area until the bottles are to be cleaned and refilled. When the bottles are used, the entire pallet load is delivered, e.g. by a fork-lift truck, to a sorting area and the individual cartons then move from the sorting area onto a conveyor. As the cartons travel along the conveyor, the empty bottles are lifted out of the cases by means of an automatic machine and transferred onto a conveyor for delivering them to a soaker. Thus, it will be seen that the handling of empty bottles in the bottling plant is a quite highly automated operation.

20 There is however one major step in this entire procedure which has not been successfully mechanized, this being the unloading of the cases of empty bottles from the pallet and placing these on a sorting table. The hand transfer of the cases of empty bottles is a very tedious and unpleasant job and is, therefore, most unpopular in a bottling plant. Numerous different attempts have been made over the years to device a mechanized system for unloading cases of empty bottles from a pallet, but these have been plagued with difficulties.

30 It is therefore, the object of the present invention to provide a device for unloading and orienting cases stacked in tiers on a pallet without the rather haphazard delivery which is characteristic of prior devices of this type.

Thus, according to the present invention an apparatus is provided for unloading and orienting articles stacked in tiers on a pallet having a tiltable pallet



receiver, a conveyor transfer section for receiving the pallet and tiered articles resting on their sides and an arrangement for removing single tiers of articles and delivering these onto a sorting table.

The tiltable pallet receiver is a structure having end walls, a side wall and a bottom wall, this receiver being supported on a support frame by means of pivotal mountings on its end walls. This is arranged so that it can in upright position receive a loaded pallet with the bottom walls substantially horizontal and then tilt until the pallet and tiered articles are resting on their sides on the receiver side wall with the article tiers forming a series of substantially vertical adjacent stacks.

Beside this pallet receiver is positioned a conveyor transfer section for receiving the pallet and tiered articles, while resting on their sides, and intermittently advancing these in a primarily horizontal direction. Adjacent the transfer section is positioned a single tier receiver for receiving a substantially vertical stack of tiered articles, i.e. articles resting on their sides, during an intermittent advance of the conveyor. This single tier receiver is horizontally movable for moving the received vertical stack laterally away from the next adjacent stack. The single tier receiver also includes a release means for dropping the stack of articles being held in a vertically downward direction while this stack is laterally separated from the next adjacent stack still being held on the conveyor transfer section. Finally, a curving delivery chute is provided beneath the single tier receiver for receiving the dropped stack and delivering the articles onto a horizontal table while resting on their bottoms.

DESCRIPTION OF PREFERRED EMBODIMENTS

The tiltable pallet receiver when in upright position has an open top and one open side and in this upright position receives a pallet loaded with cartons, e.g. from a fork-lift truck or from a warehouse vertical lift. The back wall of the pallet receiver in upright position is preferably in the form of a belted section of freely moving conveyor while the bottom is preferably in the form of a lift table, e.g. a scissor-lift. With this arrangement, after a pallet of cartons has been delivered to the pallet receiver, the receiver is tilted until the pallet and the tiered articles thereon are resting on their sides on the conveyor belt forming the back wall of the receiver. In this tilted substantially horizontal position, the lift table forming the bottom of the receiver acts as a ram to push the pallet and articles resting on their sides along the conveyor section into the adjacent conveyor transfer section. The tilting of the receiver and the movement of the lift table can be conveniently effected by means of hydraulic cylinders. When the pallet and cartons have been completely delivered onto the conveyor transfer section and secured thereon, the lift table retracts and the pallet receiver returns to its upright position for reloading.

In order to improve the stability of the stacks of cartons resting on their sides, it has been found to be particularly advantageous to position the pallet receiver as well as the adjacent conveyor transfer section on a very slight upward incline in the direction of travel of the cartons, e.g. about 10° to the horizontal.

The conveyor transfer section is designed to move the pallet and cases resting on their sides forward intermittently a distance equivalent to the height of each carton.

In other words, the conveyor transfer section intermittently advances a single stack or tier of cartons into the adjacent single tier receiver. The advancing of the cartons and pallet along the conveyor can be conveniently accomplished by means of endless chains with projecting pusher dogs for engaging the pallet bottom. These endless chains are carried on sprockets mounted on upstanding side supports above and to each side of the conveyor belt.

10           The single tier receiver can be in the form of a carriage mounted for movement along horizontal tracks. The carriage has a pair of end walls, a back wall and top and bottom walls together defining a compartment open at one side for receiving a substantially vertical stack of cartons resting on their sides from the conveyor transfer section. The top of the single tier receiver is vertically movable and acts as a clamping mechanism for securely holding the stack of cartons in the compartment. In operation, the single tier receiver moves to a position immediately adjacent the conveyor transfer section and receives a vertical stack of cartons from the transfer section. The top of  
20           the single tier receiver compartment then moves downwardly, e.g. under the action of a hydraulic cylinder, securely holding the stack within the compartment, after which the carriage moves along its tracks away from the conveyor transfer section to a position directly above the chute. The purpose of this is to create a space between the cartons being held in the conveyor transfer section and those to be dropped from the single tier receiver so that there will be no interference between the respective stacks of cartons  
30           during the drop. It is also advantageous to provide a second top clamping mechanism on the conveyor transfer section which will securely hold the first stack of cartons

thereon and prevent any of these cartons from accidentally falling into the space between the conveyor transfer section and the single tier receiver when it is positioned above the chute.

10 In order to drop the stack of cartons being held in the single tier receiver into the chute, the bottom of the receiver is preferably in the form of a horizontally slidable tray which can be actuated by means of a hydraulic cylinder. When this tray retracts, allowing a free fall of the stack of cartons, it will be appreciated that these will drop very quickly and in order to provide some control over this rate of drop, it is advantageous to provide a vertical drop chamber immediately below the single tier receiver with metering belts for controlling the vertical drop speed of the dropped cartons. The curving chute is then attached to the bottom of this vertical chamber so that the dropped cartons are smoothly and systematically delivered in an upright position onto a horizontal sorting area.

20 According to another preferred embodiment of the invention, the curving chute is pivotally mounted to the vertical chute section so that it can swing between an upper position in alignment with the horizontal sorting area and a lower position on the floor beneath the sorting area. With this arrangement, the chute is aligned with the sorting area while the stacks of cartons are being delivered and when all of the cartons on a pallet have been delivered and only the pallet itself remains, the chute is dropped to its lower position whereby the pallet itself is delivered onto the floor beneath the sorting area.

30 A preferred embodiment of the invention will now be illustrated by the accompanying drawings in which:

Figure 1 is a perspective view of the unloading and



orienting device of the present invention;

Figure 2 is an end elevation of the tiltable pallet receiver;

Figure 3 is a side elevation of the tiltable pallet receiver;

Figure 4 is a side elevation of the conveyor transfer section and single tier receiver;

Figure 5 is a top plan view of the device shown in Figure 4;

10 Figure 6 is a partial end elevation of the device shown in Figure 4 and

Figure 7 is a side elevation of the delivery chute.

As illustrated in Figure 1, the apparatus of the invention comprises as its three main parts,

- (1) a tiltable pallet receiver 10,
- (2) a conveyor transfer section 11 and
- (3) a single tier receiver 12.

#### TILTABLE PALLET RECEIVER

20 The tiltable pallet receiver has a pair of end frames 13 between which is mounted a roller conveyor assembly 14. In the tilted position as shown in detail in Figure 1 this conveyor 14 forms the bottom wall of the pallet receiver while in the upright position as shown in Figures 2 and 3 the conveyor becomes the back wall. For the roller conveyor assembly there may be conveniently used a Matthews Heavy Duty Roller Conveyor Assembly mounted between six inch channel members with  $2\frac{1}{2}$ " rolls on  $2\frac{3}{4}$ " centers with an endless belt mounted thereon. Cross tie members 15 and 20 are provided at opposite ends of the pallet receiver and mounted

30 in the bottom of the receiver in its upright position is a lift table 19. A suitable lift table is a "Blue Giant" (trade mark) hydraulic lift table capable of lifting 2,000 pounds with

cylinders and a 3.3 HP power pack. The lift table can move between a retracted position as shown in Figures 2 and 3 and an extended position as shown in Figure 1.

The pallet receiver is mounted by way of pivot shafts 16 to support columns 17 via pillow blocks 18. Mounted in this manner, the pallet receiver can be tilted between an upright position 10' and a tilted position 10 at an incline of approximately 10° to the horizontal.

10 The actual tilting of the pallet receiver is accomplished by means of air cylinder 35, the rod of which is connected to a pivotable cross bar 36 extending between end frames 13.

#### CONVEYOR TRANSFER SECTION

20 The conveyor transfer section 11 is positioned immediately adjacent the tiltable pallet receiver 10 and receives a pallet load of cartons from the pallet receiver, these cartons and pallet resting on their side and being pushed into the conveyor transfer section by means of lift table 19. The transfer section has four support legs 21 which are connected to side table support beams 23 which are inclined at about 10° to the horizontal. A pair of cross ties 22 are also provided between two of legs 21 and the legs 17 of the tiltable pallet receiver so that the two components will be in a fixed position relative to each other. Mounted as a table between support beams 23 is a second conveyor assembly 24 of the same type as that used in the pallet receiver and having an endless belt running on rollers 25. An upper frame assembly is provided including upwardly extending side bars 26 connected at their bottom end to the beams 23 and connected at the top end by cross ties 27. Additional side tie members 28 are also connected between bars 26.

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Mounted on each side of the transfer section are a pair of guide rails 29 which are resiliently mounted to beams 26 by way of spring members 56. These guide rails 29 serve to align the pallet and cartons moving through the conveyor section and will yield outwardly towards the beams 26 against the force of the spring supports.

As can better be seen from Figures 4 and 5, the conveyor transfer section has a pair of chain sprockets 30 mounted from each of the four frame members 26. These sprockets are fixed to shafts 57 at the rear end of the transfer section and shafts 33 at the front end. The shafts 33 form the main drive shaft for the sprockets on each side of the transfer section and extend downwardly to a pair of double gear boxes 34. Extending inwardly from these gear boxes 34 are an additional pair of shafts 55 which connect to a central gear box 54 which is driven by electric motor 52 through a brake and clutch 53, e.g. a Warner electric pack.

This drive mechanism drives endless chains 31 on each of which are mounted two equally spaced pusher dogs 32. These pusher dogs engage the bottom of the pallet and push the pallet and cartons intermittently on conveyor belt 24.

At the upper front edge of the conveyor transfer section is mounted an air cylinder 37 which actuates a press pad 38. This serves as a clamping device to securely hold the first tier of cartons in the transfer section in position.

#### SINGLE TIER RECEIVER

The single tier receiver is supported on a pair of horizontal side beams 39 which are fixed to the ends of beams 23 of the transfer section. These side beams 39 are joined by cross beam 40 to provide a rigid base structure. The single tier receiver is in the form of a carriage which moves back and forth while supported on tracks 58 mounted

on the inner faces of the support beams 39. The carriage has a pair of side walls 41 mounted to a support 42 for travelling on the tracks 58. A cross tie 43 connects the lower portions of the end plates 41 and a stop plate assembly 44 extends across between plates 41 at an intermediate position. As viewed from Figure 1, this stop plate 44 is positioned inwardly from the right-hand edge of end plates 41 sufficiently to receive a single tier of cartons. In other words, the portion to the right of the stop plate 44 is a single tier receiving compartment. The bottom of this compartment is closed by way of a slide plate 59 which is horizontally movable by way of pneumatic cylinder 48. The tier of cartons is firmly held in the single tier receiving compartment by way of a press pad 45 which is vertically actuated by means of air cylinder 46 supported in cross beam 60.

Thus, it will be seen that the single tier receiver carriage 12 can travel back and forth horizontally along its support tracks in the direction of arrow 61 between a position as shown in Figure 1 in which the single tier receiving compartment is vertically aligned above chute 49 and a position as shown in Figure 4 where the compartment is immediately adjacent the end of the conveyor transfer section 11. An air cylinder 63 is connected to the carriage to effect the back and forth horizontal movement. The carriage is pivotally mounted at points 62 so that by actuation of air cylinder 47 the carriage can be caused to tilt through an angle of about 10° and the single tier receiving compartment will be in complete alignment with the end of the conveyor transfer section. In this position the transfer conveyor pusher dogs are actuated moving a single tier of cartons into the single tier receiving compartment. When

this had been done air cylinders 37 and 46 are actuated so that the first tier of cartons remaining in the transfer conveyor and the tier being held in the tier receiving compartment are firmly clamped in place. Then cylinder 47 retracts causing the loaded carriage to tilt back to the position shown in Figure 4, cylinder 63 is activated to push the carriage into the position shown in Figure 1, at which time cylinder 48 retracts, withdrawing the slide 59 and allowing the single tier of cartons being held in the compartment to drop down and out chute 50.

10

Between the curving chute 50 and the single tier receiver 12 is positioned a vertical drop chamber 49 for receiving the cartons dropped from the single tier holding compartment and allowing these cartons to move onto the curved chute in a controlled manner. This is accomplished by means of a pair of metering belts 64 which are inclined toward each other in a downward direction as shown in Figure 4. The metering belts are mounted at their upper ends on rollers 65 and at their lower ends on rollers 66. The rollers 66 are adjustable by way of the adjustment screws 67 to control the tension on the belts 64.

20

The curving chute 50 is pivotally connected to the bottom end of the decelerating drop chamber 49 by way of pivotal connection 68. A support frame 69 is provided towards the lower end of chute 50 for holding the chute in either an upper position 50 as shown in Figure 1 or a lower position 50'.

#### CONTROL EQUIPMENT

The apparatus can with some simple control equipment be operated on a semi-automatic basis. The drive motor 52 for the transfer conveyor runs continuously with the intermittent movement of the pusher dogs 32 being controlled by

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the brake-clutch device 53. Limit switches are positioned adjacent the stop plate 44 of the single tier receiving compartment so that when the pusher dogs 32 are activated, they push the entire load in the transfer conveyor forward until a tier is in position in the single tier compartment thus tripping the limit switches. This disengages the clutch 53, immediately stopping the movement of the pusher dogs 32. The limit switches in the single tier receiving compartment also activate the air cylinders 37 and 46 to securely clamp the tier in the single tier receiving compartment and the first tier remaining in the transfer conveyor.

The downward movement of the press plate 45 into engagement with the tier trips a further switch causing release of the air cylinder 47 so that carriage 12 can swing down from its inclined position in alignment with the transfer conveyor into a vertical position. The return of the carriage to its vertical position trips a further switch which activates cylinder 63, pushing the carriage 12 until the single tier compartment holding a load of cartons is in alignment directly above the drop chamber 49. The movement of the carriage into this position trips a limit switch causing activation of air cylinder 48 which retracts slide tray 59 thus releasing the stack of cartons being held in the single tier compartment into the drop chamber 49.

The drop chamber can be provided with a photoelectric cell which indicates when the chamber is empty and this sets off a repeat of the cycle in the reverse direction whereby the carriage returns to its position in close alignment with the transfer conveyor and the pusher dogs are activated to deliver another vertical tier of cartons in the single tier receiver.

When all of the cartons on a pallet have been

delivered down chute 50, the pallet itself is pushed into the single tier receiving compartment. The pusher dogs 32 are of sufficient length that as they move on their support chains around sprockets 30, they push the pallet into the compartment sufficiently far to trip the limit switches. This completes one cycle of the pusher dogs and the completion of this cycle trips a switch which activates an air cylinder to move the chute into its lower position 50' so that pallet will be delivered out beneath the sorting table 51.

10

During the automatic detiering sequence, an operator with manual controls can have returned the tiltable pallet receiver to its upright position to receive another loaded pallet from a fork-lift truck and have tilted the receiver back to the position shown in Figure 1. When the pallet itself leaves the transfer conveyor, the lift table in the pallet receiver can be activated pushing the pallet and the load of cartons thereon into the transfer conveyor so that the next automatic detiering cycle can be commenced.

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An apparatus for unloading and orienting articles stacked in tiers on a pallet comprising:
  - (a) a tiltable pallet receiver having end walls, a back wall and a bottom wall, said receiver being supported on a support frame by means of pivotable mountings on said end walls, whereby it can in upright position receive a loaded pallet with the bottom wall substantially horizontal and then tilt until the pallet and tiered articles are resting on their sides on the receiver side wall with the article tiers forming a series of substantially vertical adjacent stacks,
  - (b) a conveyor transfer section for receiving the pallet and tiered articles resting on their sides and intermittently advancing these in a primarily horizontal direction,
  - (c) a single tier receiver for receiving a substantially vertical stack of tiered articles during an intermittent advance of the conveyor transfer section, said tier receiver being horizontally movable for moving the received stack laterally away from the next adjacent stack,
  - (d) release means for dropping the stack of articles being held in the receiver in a vertically downward direction, and
  - (e) a curving delivery chute for receiving the dropped stack and delivering the articles in an upright position onto a horizontal table.



2. An apparatus according to claim 1 wherein the pallet receiver bottom wall comprises a scissor lift table for pushing the loaded pallet out of the receiver when in the tilted position.
3. An apparatus according to claim 2 wherein the pallet receiver side wall comprises a freely moving belt conveyor.
4. An apparatus according to claim 3 wherein the pallet receiver is tilted by means of an air cylinder.
5. An apparatus according to claim 1 wherein the conveyor transfer section comprises a freely moving belt conveyor table and upstanding side supports carrying endless chains with projecting pusher dogs for engaging the pallet bottom and pushing the pallet and tiered articles along the belt.
6. An apparatus according to claim 5 wherein the conveyor transfer section includes a vertically movable horizontal clamping bar in an upper section thereof immediately adjacent the single tier receiver, whereby the first stack of articles remaining in the conveyor transfer section is held securely in place while the stack in the single tier receiver is moved laterally and dropped.
7. An apparatus according to claim 1 wherein the single tier receiver comprises a carriage mounted for movement along horizontal tracks, said carriage having a pair of end walls, a back wall, a top and a bottom defining a compartment open at one side for receiving a stack of articles from the conveyor transfer section, said top being vertically movable to act as a clamping mechanism, for securely holding the stack of articles in the compartment, and said bottom being openable for releasing the held stack into the delivery chute.

8. An apparatus according to claim 7 wherein the top clamp is actuated by an air cylinder.
9. An apparatus according to claim 7 wherein the bottom comprises a horizontally slidable tray.
10. An apparatus according to claim 9 wherein the slidable tray is actuated by an air cylinder.
11. An apparatus according to claim 7 wherein the pallet receiver in tilted position and the conveyor transfer section are inclined upwardly about  $10^{\circ}$  in the direction of the single tier receiver.
12. An apparatus according to claim 11 wherein the single tier receiver is tiltable through an angle of about  $10^{\circ}$  whereby it tilts into alignment with the conveyor transfer section for receiving a stack of articles and then returns to a vertical position for releasing the stack into the chute.
13. An apparatus according to claim 7 wherein a vertical chute section is positioned immediately below the single tier receiver, the curving chute being pivotally attached to the bottom of the vertical chute section.
14. An apparatus according to claim 13 wherein the vertical chute section includes metering belts for controlling the vertical drop speed of the dropped articles.



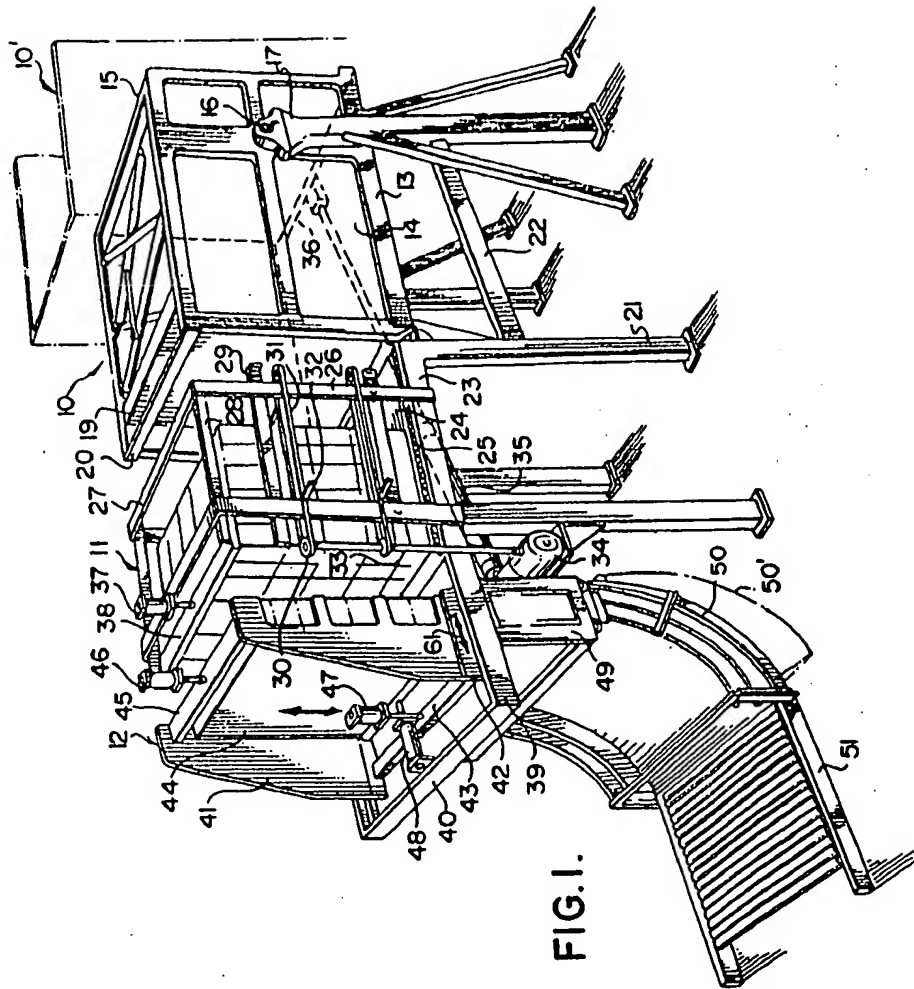


FIG. 1.

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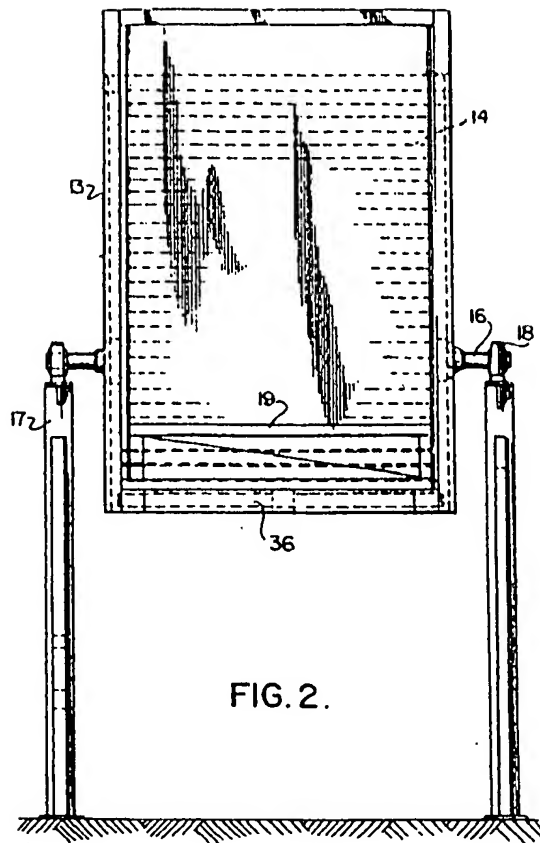


FIG. 2.

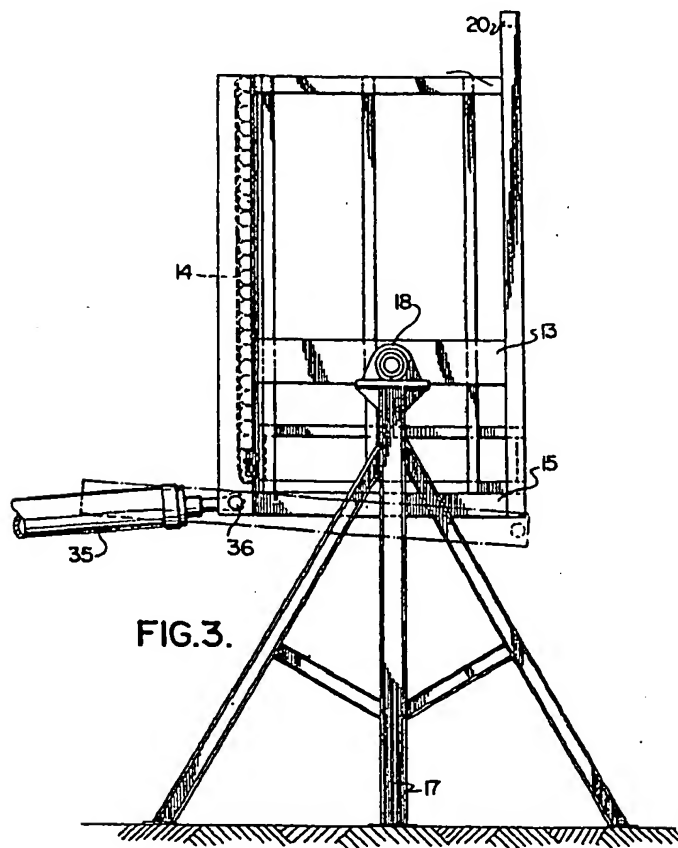
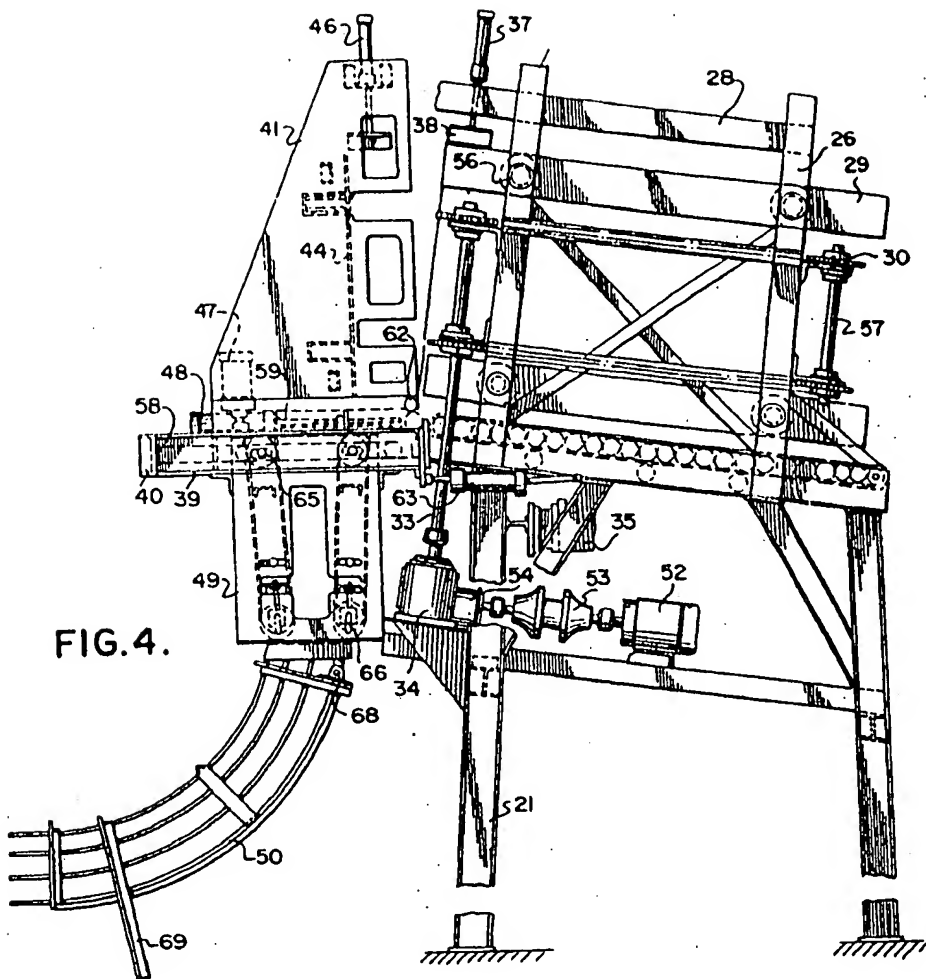
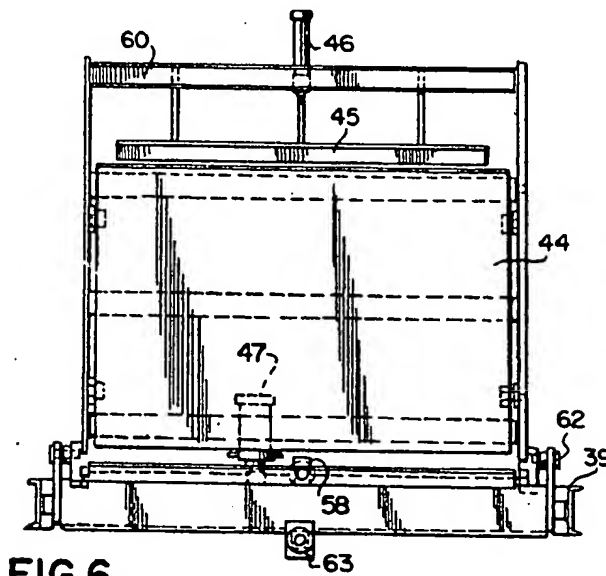
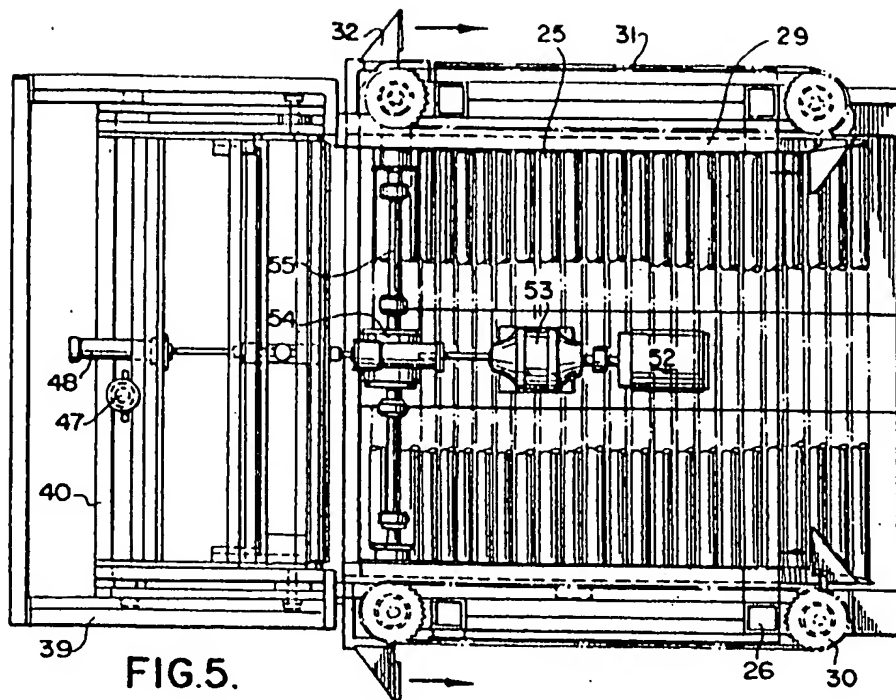


FIG. 3.

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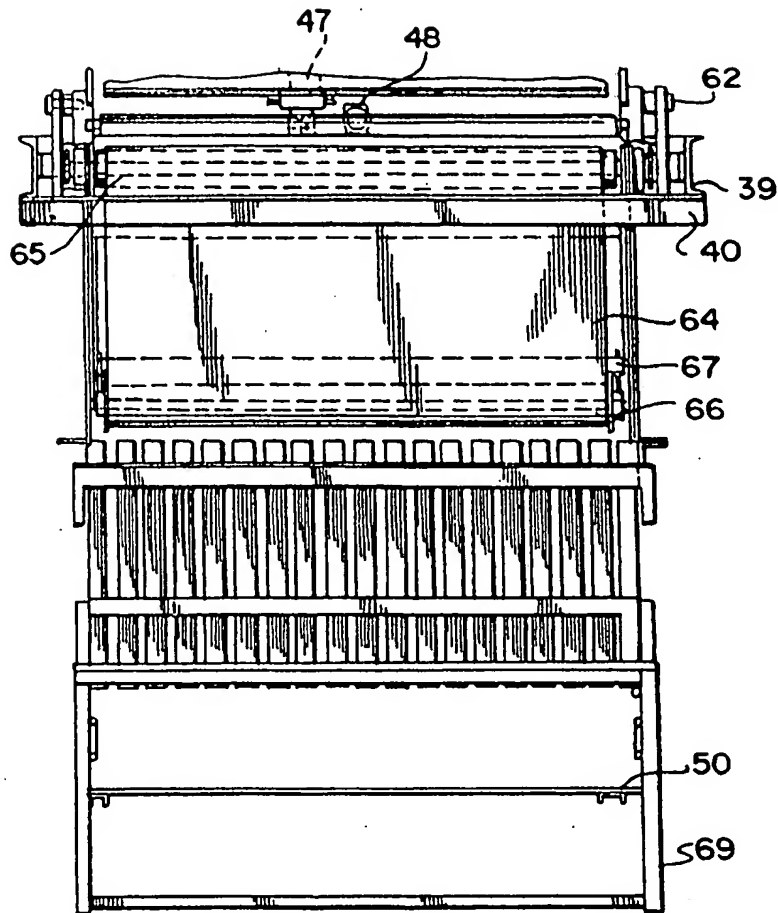


FIG. 7.

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